

Wheeler Laboratories, Inc.

A SUBSIDIARY OF HAZELTINE CORPORATION

Harold A. Wheeler, President

Box 561, Smithtown, N. Y. 11787

Andrew 5-3810

FACILITY FORM 602	N64-33039	(ACCESSION NUMBER)		(THRU)
	3	(PAGES)		(CODE)
	NASA CR 58820	(NASA CR OR TMX OR AD NUMBER)	17	(CATEGORY)

File 466

TL-6

ERS/vmg

1964 SEP 16

Director, Electronics and Control Division (Code RET)
Office of Advanced Research and Technology
National Aeronautics and Space Administration
Washington, D. C.

Attention: Mr. Roland Chase

Reference: Contract NASw 888.

Subject: Development of Macroscopic Optical Waveguide
Components -- Progress 1964 AUG.

Gentlemen:

OTS PRICE

	1.00	
		.50
XEROX	\$	\$
MICROFILM		

This is the sixth progress report on the development of macroscopic waveguide components for optical systems being performed for the National Aeronautics and Space Administration (NASA) by Wheeler Laboratories (WL) under contract NASw 888. This report covers the month of August 1964. The overall objectives of the current contract, to be completed by 1964 NOV 28 as described in Ref. 1 are: (1) to determine the factors affecting the design and fabrication of macroscopic waveguide and waveguide components, (2) to investigate specific configurations in order to develop practical concepts for component design, and (3) to undertake actual component fabrication and testing to prove the feasibility of the design concepts.

Work Performed During Current Month.

During the month of August, effort has continued on the second phase of this program which involves the following tasks:
(1) a study and performance analysis of component configurations,
(2) design, fabrication and testing of certain components.

A. Analysis of Waveguide and Waveguide Components.

The possibility of constructing a directional coupler from a single sheet of microsheet glass is being studied. Previous tests of these sheets (Ref. 6) indicated a gradient in refractive index in the sheet cross-section giving a low index in the center and high index at the edges. Therefore, the sheet can act as two coupled waveguides. Experimental tests to demonstrate this coupling are planned.

B. Experimental Testing.

Two quartz slabs ($2\frac{1}{2}$ mils thickness) were received from Dell Optics Co. for use as solid core waveguides. Experimental testing of these slabs indicated good propagation of low order modes, and single mode propagation over limited regions of the slab. The single mode performance is considered marginal and gives evidence of random inhomogeneities in the refractive index of the quartz. Slabs of the same size, but made from better quality quartz or glass will be purchased.

Implementation of an optical modulator constructed in waveguide has been initiated. Preliminary measurements of the voltage breakdown strength of the modulator electrodes in nitrobenzene have been performed. The modulator configuration has been designed and is being assembled.

C. Survey and Study of Waveguide Construction.

The survey of various plastic materials for construction of an all-solid waveguide indicates that methyl methacrylate (common names lucite, plexiglas) has the best optical properties for a waveguide application. However this plastic is not available commercially in thin sheets. Methods for obtaining thin sheets or for changing the properties of the material over a thin region are being investigated.

D. Conferences.

A conference with R. Chase and other NASA personnel to review progress on this contract has been tentatively scheduled for October.

Work Planned for Next Month.

During the month of September, it is planned to continue the experimental evaluation of different types of waveguides and the design, performance analysis, and testing of certain components.

- (1) Further testing of better quality quartz slabs is planned.
- (2) Experimental testing of a modulator constructed in waveguide will continue.
- (3) Implementation of a plastic waveguide will be continued.


Personnel.

The work on this project has been carried on by E. R. Schineller, D. W. Wilmot and H. M. Heinemann under the direct supervision of H. W. Redlien. Advice and general direction has been provided by H. A. Wheeler and F. H. Williams.

References.

- (1) D. W. Wilmot, R. A. Kaplan, "Development of Macroscopic Waveguide and Waveguide Components for Optical Systems", Wheeler Labs. Report 1139; April 1, 1963.
- (2) E. R. Schineller, "Development of Macroscopic Optical Waveguide Components -- Progress 1964 February", Technical Letter No. 1 to NASA; 1964 March 17.
- (3) H. W. Redlien, "Development of Macroscopic Optical Waveguide Components -- Progress 1964 March", Technical Letter No. 2 to NASA; 1964 April 15.
- (4) H. W. Redlien, "Development of Macroscopic Optical Waveguide Components -- Progress 1964 April", Technical Letter No. 3 to NASA; 1964 May 19.
- (5) E. R. Schineller, D. W. Wilmot and H. M. Heinemann, "A Macroscopic Waveguide Medium for Laser System Components", Wheeler Labs. Report 1209; June 10, 1964.
- (6) E. R. Schineller, "Development of Macroscopic Optical Waveguide Components -- Progress 1964 May-June", Technical Letter No. 4 to NASA; 1964 July 23.
- (7) E. R. Schineller, "Development of Macroscopic Optical Waveguide Components -- Progress 1964 July", Technical Letter No. 5 to NASA; 1964 Aug. 24.

Very truly yours,



E. Ronald Schineller
Assistant Project Supervisor

cc: R. H. Chase (1 extra copy)
H. Harrison
Dr. G. Allen Smith
Duncan McIver
Trindel Ferguson
Dr. Max Nagel
Dr. H. H. Plotkin
Dr. Willard H. Wells
E. J. Reinbolt
W. L. Thompson
NASA Representative (14 copies)
Bethesda, Maryland